

Dental panoramic tomography (DPT)

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Panoramic imaging (also called pan tomography) is a technique for producing a single tomographic image of the facial structures that includes both the maxillary and mandibular dental arches and their supporting structures.

Principles of Panoramic Image Formation:

Lead collimators in the shape of a slit, located at the x-ray source and at the image receptor, limit the central ray to a narrow vertical beam. The center of rotation is located off to the side, away from the objects being imaged. During the exposure cycle, the machine automatically shifts to one or more additional rotation centers. The rate of movement of the receptor behind the slit is regulated to be the same as that of the central ray sweeping through the dental structures on the side of the patient nearest the receptor. Structures on the opposite side of the patient (near the x-ray tube) are distorted and appear out of focus because the x-ray beam sweeps through them in the direction opposite that in which the image receptor is moving. In addition, structures near the x-ray source are so magnified (and their borders so blurred) that they are not seen as discrete images on the resultant image.

Main indications of DPT:

- ❖ As part of an orthodontic assessment dentition and the presence/absence of teeth.
- ❖ To assess bony lesions or an unerupted tooth.
- ❖ Prior to dental surgery under general anaesthesia.
- ❖ As part of an assessment of periodontal bone support where there is pocketing greater than 5 mm.
- ❖ Assessment of third molars, at a time when consideration needs to be given to whether they should be removed or not.
- ❖ Fractures of all parts of the mandible except the anterior region
- ❖ Antral disease — particularly to the floor, posterior and medial walls of the antra
- ❖ Destructive diseases of the articular surfaces of the TMJ
- ❖ Vertical alveolar bone height as part of preimplant

Field limitation techniques:

X-ray to certain parts of the jaws when specific information is required, instead of the entire dentition. This results in a significant radiation dose reduction.

Image layer:

The image layer is a three-dimensional curved zone, or “ focal trough, where the structures lying within this layer are reasonably well defined on final panoramic image. The structures seen on a panoramic image are primarily those located within the image layer. Objects outside

the image layer are blurred, magnified, or reduced in size and are sometimes distorted to the extent of not being recognizable.

Advantages of DPT:

- A large area is imaged and all the tissues within the focal trough are displayed on one Film, including the anterior teeth, even when the patient is unable to open the mouth.
- The image is easy for patients
- Positioning is relatively simple and minimal expertise is required.
- The view of both sides of the mandible on one film is useful when assessing fractures and is comfortable for the injured patient.
- The overall view is useful for evaluation of periodontal status and in orthodontic assessments.
- The antral floor, medial and posterior walls are well shown.
- Both condylar heads are shown on one film.
- Development of field limitation techniques with resultant dose reduction.

Disadvantages of DPT:

- The tomographic image represents only a section of the patient. Structures or abnormalities not in the focal trough may not be evident.
- Soft tissue and air shadows can overlie the required hard tissue structures.
- Ghost or artefactual shadows can overlie the structures in the focal trough.
- The tomographic movement together with the distance between the focal trough and film produce distortion and magnification of the final image (approx. x 1.3).
- The use of indirect-action film and intensifying screens results in some loss of image quality.
- The technique is not suitable for children under 5 years or on some disabled patients because of the length of the exposure cycle.
- Some patients do not conform to the shape of the focal trough and some structures will be out of focus.

Interpreting the Panoramic Image:

Recognizing normal anatomic structures on panoramic radiographs is challenging because of the complex anatomy of the midface, the superimposition of various anatomic structures, and the changing projection orientation. The many potential artifacts associated with machine and patient movement, patient positioning, and unusual patient anatomy must be identified and understood.

1-The mandible:

Major anatomic areas of this curved bone (real)

- Condylar process and temporomandibular joint
- Coronoid process
- Ramus
- Body and angle
- Anterior sextant
- Mandibular dentition and supporting alveolus

Shadows of other structures that can be superimposed over the mandibular ramal area include the following:

- Pharyngeal airway shadow,
- Cervical vertebrae,
- Ear lobe and ear decorations
- Nasal cartilage and Soft palate
- Dorsum of the tongue and Ghost shadows of the opposite side of the mandible

2-Midfacial region:

As with the mandible, the maxilla can be compartmentalized into major sites for examination:

- Cortical boundary of the maxilla, including the posterior border and the alveolar ridge.
- Pterygomaxillary fissure
- Maxillary sinuses
- Zygomatic complex, including inferior and lateral orbital rims, zygomatic process of maxilla, and anterior portion of zygomatic arch
- Nasal cavity and conchae
- Maxillary dentition and supporting alveolus

Technique and positioning:

General requirements that are common to all machines and these can be summarized as follows:

- Patients should be asked to remove any earrings, jewellery, hair pins, spectacles, dentures or orthodontic appliances. Patients are positioned with their backs and spines as erect
- The procedure and equipment movements should be explained, to reassure patients.
- A protective lead apron should not be used.
- Patients should be placed accurately within the machines using the various head-positioning devices and light-beam marker positioning guides.
- Patients should be instructed to place their tongue into the roof of the mouth so that it is in contact with the hard palate and not to move throughout the exposure cycle (approximately 18 seconds).

The importance of accurate patient positioning:

The positioning of the patient's head within this type of equipment is critical. It must be positioned accurately so that the teeth lie within the focal trough. The anteroposterior position radiograph of the patient is achieved typically by having patients place the incisal edges of their maxillary and mandibular incisors into a notched positioning device (the bite block). Patients should not shift the mandible to either side when making this protrusive movement. The midsagittal plane must be centered within the image layer of the particular x-ray unit.

Too far posterior results in magnified mesiodistal dimensions through the anterior sextants and resulting "flat" teeth. Too far anterior results in reduced mesiodistal dimensions through the anterior sextants and resulting "thin" teeth. Poor midline positioning (asymmetrically) is a common error, causing horizontal distortion in the posterior regions, excessive tooth overlap in the premolar regions. The smaller side is too close to the receptor and the larger side is too close to the x-ray source.

A general guide for chin positioning is to place the patient so that a line from the tragus of the ear to the outer canthus of the eye is parallel with the floor. If the chin is tipped too high, the occlusal plane on the radiograph appears flat or inverted, and the image of the mandible is distorted. In addition, a radiopaque shadow of the hard palate is superimposed on the roots of the maxillary teeth. If the chin is tipped too low, the teeth become severely overlapped, the

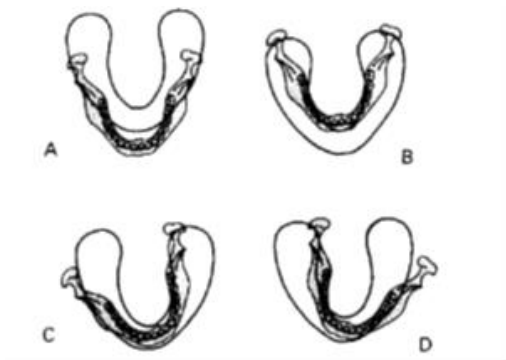
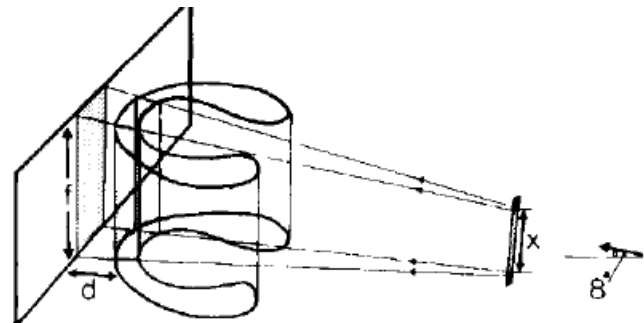
symphyseal region of the mandible may be cut off the film, and both mandibular condyles may be projected off the superior edge of the film

Allowing patients to slump their heads and necks forward causes a large opaque artifact in the midline created by the superimposition of an increased mass of cervical spine. This shadow obscures the entire symphyseal region of the mandible.

Patient still wearing earrings, jewellery, dentures or orthodontic appliances will result in artefactual shadow(s) of the offending object.

Failure to instruct the patient to keep still throughout the cycle lead to Vertical or horizontal distortion of the part of the image being produced at the time of the movement.

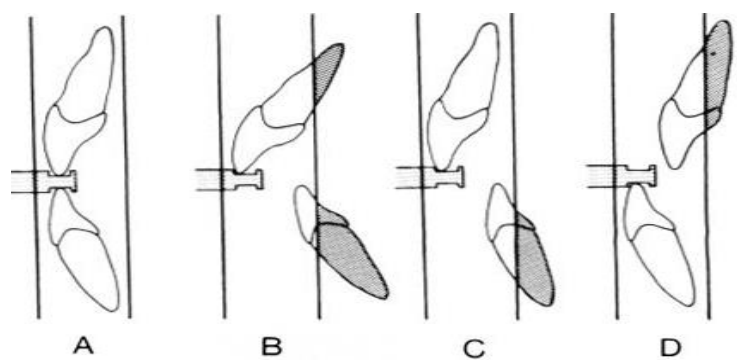
NOTE:- The separation of the focal trough and the film (d), coupled with the 8° upward angulation of the X-ray beam results in the final image being slightly magnified



A :The patient is too close to the film

and in front of the focal trough.
B :The patient is too far away from the film and behind the focal trough.

C and D: The patient is placed asymmetrically within the machine



A :Class I. B :Gross class II division 1 malocclusion with large overjet. C: Angle's class II skeletal base. D: Angle's class III skeletal base. The shaded areas outside the focal trough will be blurred and out of focus.